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COMPENSATION
PROGRAM

BC hydro

BRITISH COLUMBIA

Winter Survey of Trumpeter Swans in The Central Interior, British Columbia, February 2001

F. B. Corbould
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Introduction

Ice-free sites in the Central Interior of British Columbia (BC) provide the northern-most over-wintering areas for trumpeter swans (*Cygnus buccinator*) in North America (King 1981). At least 500 swans annually winter in the Central Interior bounded by Prince George and Francois Lake in the south and Takla Lake and the Crooked River in the north (McKelvey and Burton 1983, King 1981).

Local First Nations people have observed trumpeter swans wintering in the Central Interior since the late 1800s (King 1981). Since the 1970s, the Ministry of Environment, Lands and Parks (MELP) and local naturalists have conducted ad hoc winter counts (MELP unpublished data). All naturalists' surveys have been conducted opportunistically from ground access points while MELP has conducted sporadic aerial surveys on localised areas. Last year, Corbould and Hengeveld (2000) conducted an intensive survey of ice-free sites and identified use by water-dependent wildlife (including swans) but the survey was restricted to the Williston Reservoir watershed that encompasses the northeastern half of the Central Interior's winter swan population. Prior to 2001, the only extensive survey of swans wintering in the Central Interior was conducted by MELP in mid-March 1990; swans were counted in co-ordination with moose (*Alces alces*) surveys that were being conducted in the area (MELP unpublished data). An estimated 975 swans were observed along the Stuart, Tachie, Middle, Nautley, Stellako, upper Nechako, Chuchi Lake/Nation, and Crooked Rivers, and the Bowron Lake Park area; it was noted that more than 1,000 birds were likely present due to conservative estimates made at some locales. Due to the timing of the survey, however, the count may have included individuals that had over-wintered in more southern areas (i.e., some swans had possibly started their spring migration).

Given the limited understanding regarding the number of trumpeter swans wintering in the Central Interior of BC and the fact that the one in 5-year North American swan surveys (breeding and wintering) were being conducted in 2000/01, a thorough survey of swans wintering in the Central Interior was proposed. Fortunately, thanks to funding provided by the Canadian Wildlife Service (Surrey), MELP (Prince George), and the Peace/Williston Fish and Wildlife Compensation Program (Prince George), a survey was able to be conducted. This report documents the winter trumpeter swan survey conducted within the Central Interior of BC during February 2001.

Survey Area and Methods

Six main areas were targeted to be surveyed: Nautley River, Stellako River, Stuart River, Tachie River, Middle River, and Crooked River (Figure 1). As well, due to their close proximity to the intended survey route, 3 secondary sites that potentially had ice-free sites and swans present were scheduled to be surveyed: the Nation Lakes and upper Nation River area, the upper McLeod River, and the outlet of Tacheeda Lakes. Two additional locations that possibly had wintering swans present (Irvine residence on upper Nechako River and the Bowron Lake Park area; Figure 1 and 2) were not included in the aerial survey as they were situated in more remote locations and the data for these sites could possibly be obtained by other means (e.g., a local resident and MELP/BC Parks staff, respectively).

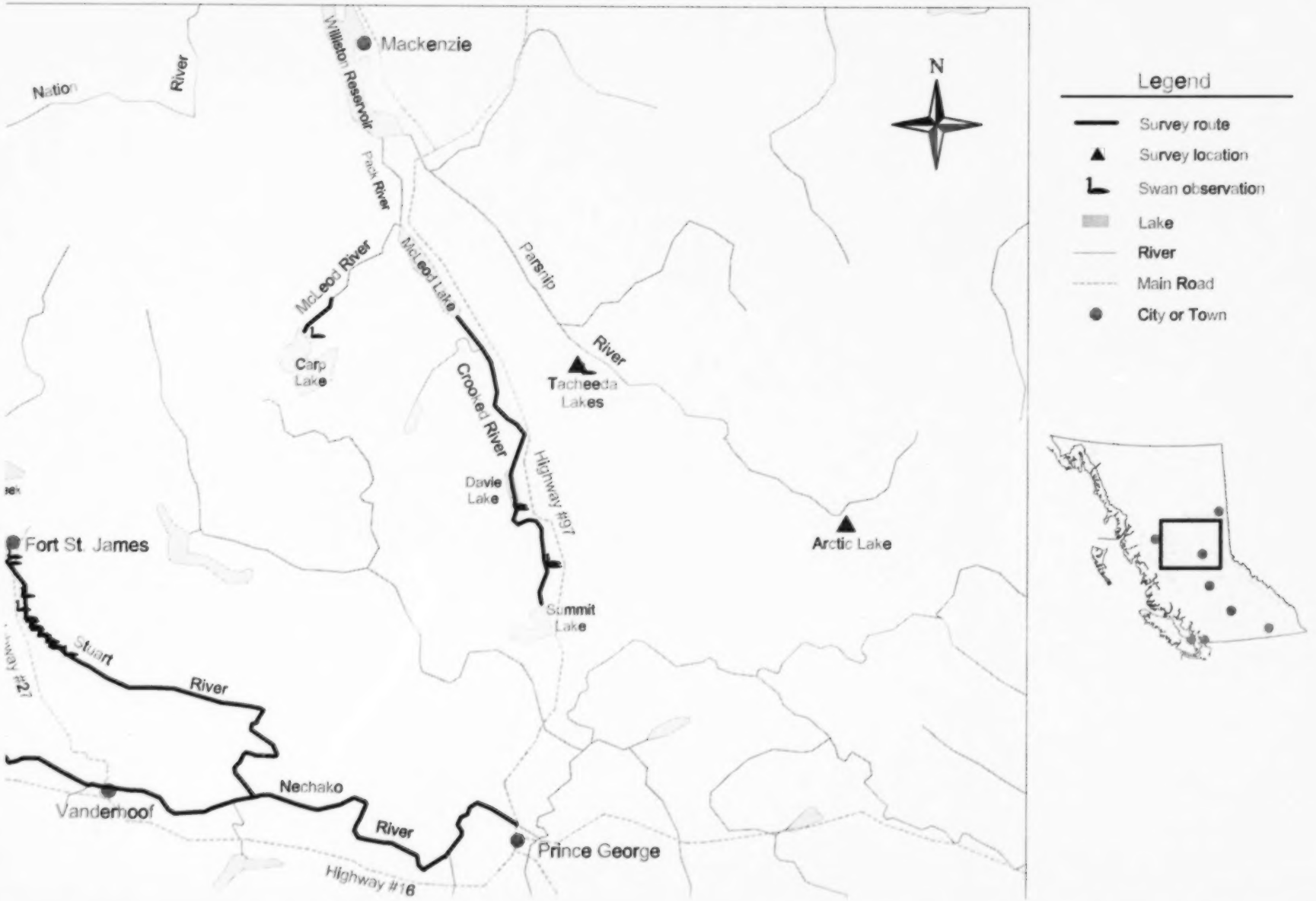
Watercourses with ice-free sites in the Central Interior are the consequence of warmer water exiting from lakes, warm water springs, and faster flowing water (King 1981, Corbould and Hengeveld 2000). All sites surveyed are situated within the Sub-Boreal Spruce biogeoclimatic zone, except for the Babcock Creek site (Bowron Lake Park) that lies within the Interior Cedar-Hemlock zone (Ministry of Forests 1992). Most areas surveyed by helicopter were situated along larger river systems from 868 m (Chuchi Lake [Nation River]) down to 570 m (Prince George [Nechako River]) in elevation, but a couple of areas were located on smaller systems (McLeod River [Carp Lake] 844 m and Tacheeda Lakes 726 m). The Bowron Lake Park sites were between about 890 m and 915 m in elevation.

Freezing conditions in the Prince George and surrounding area typically begin in October and last until late March, with minimum temperatures periodically reaching below –30°C during the November to March period (Environment Canada 1998). Normal mean monthly temperatures (30-year averages, 1961-1990) for November through March range between -1°C and -10°C (Table 1; Environment Canada 1998).

Table 1. Mean monthly winter temperatures (2000/01 and 30-year normals[a]) for Prince George (Environment Canada 1998 and 2001).

	Mean monthly temperatures (°C)									
	November		December		January		February		March	
	2000	Normal	2000	Normal	2001	Normal	2001	Normal	2001	Normal
Prince George										
Maximum	1.9	0.6	-4.4	-4.5	-0.2	-5.8	na	-0.7	na	4.6
Minimum	-4.0	-6.8	-11.8	-12.5	-8.3	-14.1	na	-10.3	na	-6.0
Mean	-1.1	-3.1	-8.1	-8.4	-4.3	-9.9	na	-5.4	na	-0.7

[a] Monthly 30-year normals are for the period 1961 to 1990.


Mackenzie
Williston Reservoir
Nation
River
Parsnip River
McLeod River
McLeod Lake
Carp Lake
Crooked River
Tacheeda Lakes
Parsnip River
Davie Lake
Highway #97
Arctic Lake
Summit Lake
Fort St. James
Stuart River
Nechako River
Vanderhoof
Prince George
Highway #16
N
Legend
Survey route
Survey location
Swan observation
Lake
River
Main Road
City or Town

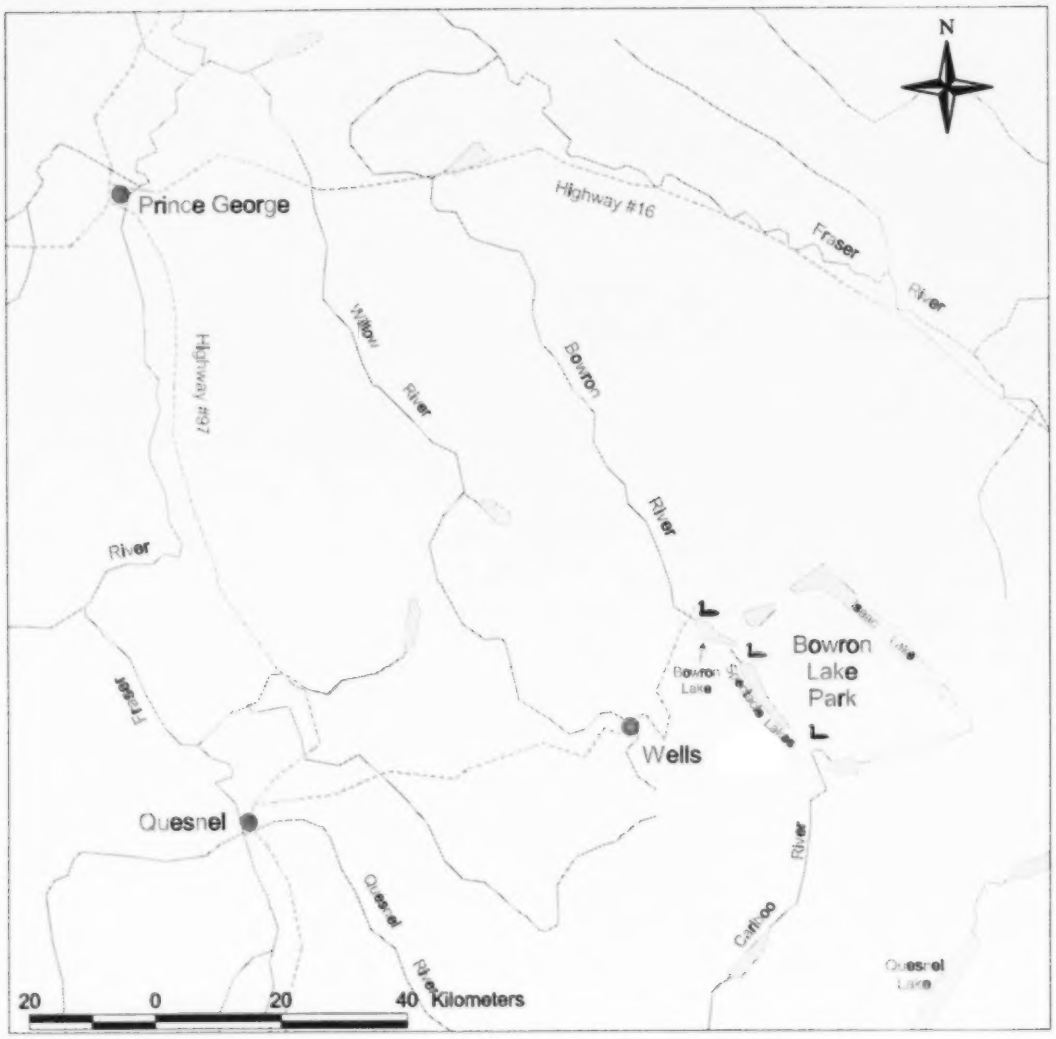


Figure 2. Location of trumpeter swan observations reported from Bowron Lake Park (Central Interior, BC), 14 February, 2001.

The aerial survey was conducted from a Bell 206 helicopter with a four-person crew, including the pilot. The helicopter travelled 30 to 75 m above the watercourse being surveyed and at a speed of about 100 to 180 km/hr. The crew searched for and recorded the presence all trumpeter swans. Swans were classed as adult or juvenile (cygnet). Location co-ordinates for each swan group (1 or more bird) were determined using the aircraft's on-board Global Positioning System. If a number of swans were in close proximity to one another (approx. <100 m), even though they may have been situated in discrete smaller groups, only one set of co-ordinates was recorded. Other water-dependent wildlife observed were enumerated and classified to species and, if possible, sexed or aged. All goldeneyes were considered to be common goldeneyes (*Bucephala clangula*) unless positively identified otherwise.

Location co-ordinates and size characteristics (length and width) for ice-free sites observed along the survey route were recorded. For longer sites, the start and end co-ordinates were recorded for the ice-free area. The size of each site was estimated visually and categorised into their respective measurement classes. Site width was classified into 1 of 5 categories: <2.5 m, 2.5 to 4.9 m, 5.0 to 7.4 m, 7.5 to 9.9 m, and ≥10.0 m. Length classes were <20 m, 20 to 99 m, 100 to 499 m, 500 to 999 m, and ≥1,000 m. Photographs were taken opportunistically during the survey.

Survey Results

The survey of trumpeter swans wintering in the Central Interior of BC in February 2001 identified 1,293 birds (Table 2; Appendix A); swans were counted during an aerial swan survey conducted on 10 February, at Bert Irvine's residence along the upper Nechako River on 11 February, and incidentally within Bowron Lake Park by BC Parks staff on 14 February. The majority of swans observed were found at sites along the Stuart River (426 birds), Middle River (345), Tachie River (141), Crooked River (94), and at the Irvine residence (130) (Figure 1). Smaller numbers were observed on the Nautley River (66 swans), Stellako River (43), and 5 other areas (≤16). Although a 15-km section near the eastern end of Francois Lake was surveyed (both north and south shorelines), the entire open water portion of the lake was not surveyed. Francois Lake was reported to be ice free to just west of the ferry crossing, thus resulting in up to 35 km of open water not being surveyed. No swans were reported to be near the ferry crossing in February (BC Ferries staff, Francois Lake, personal communication) but I suspect that a few swans were overlooked on the lake; the number of swans missed, however, was unlikely more than 40 and probably less than

Table 2. Distribution and abundance of trumpeter swans and other water-dependent wildlife found using ice-free sites in the Central Interior, February 2001. Includes data from aerial survey (10 February), ground-based count at Irvine residence on upper Nechako River (11 February), and incidental sightings by BC Parks within Bowron Lake Park (14 February).

	Ice-free Sites		Water-dependent Wildlife Observed[a]						
System	Total	With Swans	TRUS[b]	CAGO	MALL	COGO	COME	BAEA	AMDI
Nechako River	15[c]	1	130 (14)		40			5	2
Nautley River	1[c]	1	66 (5)		30	7		2	1
Stellako River	3	1	43 (0)		11	38	26	25	12
Francois Lake	1[d]	1	12 (2)			2	28	3	
Stuart River	28	1	426 (80)			89	30	6	
Pinchi Creek	1								
Tachie Creek	12	3	141 (25)			5	6	1	4
Middle River	11	5	345 (70)		13	40		1	
Nation Lakes/River	3	2	16 (2)			26	5		3
McLeod River	4	1	4 (0)		9				2
Crooked River	24	5	94 (26)	3	18	5	9		6
Tacheeda Lakes	3	1	4 (1)						1
Arctic Lake	1								3
Bowron Lake Park	n/a	4	12 (0)						
Total	**106**	**26**	**1,293 (225)**	**3**	**121**	**212**	**104**	**43**	**34**

[a] Species: TRUS (trumpeter swan); CAGO (Canada goose), MALL (mallard); COGO (common goldeneye); COME (common merganser); BAEA (bald eagle), and AMDI (American dipper).

[b] Total number of trumpeter swans (number of cygnets) observed.

[c] Site #OW-12 included the entire Nautley River and a section of the Nechako River downstream of the Nautley River confluence, therefore an ice-free site is counted in both the Nechako and Nautley totals (only counted once in Central Interior total).

[d] Only a portion of Francois Lake ice-free site was surveyed; Francois Lake reported to be ice free to just west of ferry crossing.

20. The open water along the upper Nechako River (Irvine site) would not normally provide suitable wintering habitat but swans are present at the site due to artificial feeding.

Cygnets represented 17.4% (225 birds) of the swans observed (Table 2). This is substantially lower than the 29% cygnet representation reported by King (1981). The Crooked River had the highest proportion (27.7%) of cygnets present, which is notably higher than the 16% average documented from prior surveys on the river (Corbould and Hengeveld 2000). The only area that had appreciable swan numbers and no cygnets present was the Stellako River.

No neck bands were observed on swans to help identify what population the Central Interior swans originate from (e.g., Pacific Coast or Rocky Mountain). However, a leg band on the right leg of a swan at the Irvine residence was noted; the bird could not be approached

sufficiently to identify the band number or material (Bert Irvine, personal communication). The sparse literature and minimal records of banded birds for the Central Interior has indicated, at least for the Stuart and Nautley River areas, that these swans are part of the Pacific Coast population (Campbell et al. 1990, McKelvey and Burton 1983, MELP unpublished data).

One hundred and six (106) ice-free sites were observed at 86 locations during the aerial survey (Table 2; Appendix B); it is unknown how many ice-free sites were present along the upper Nechako River (upstream of Nautley River confluence) and within Bowron Lake Park, other than the 5 sites where swans were observed. Ice-free sites ranged in size from small openings (e.g., 10 m by 2 m) to extensive river sections (>5 km) being open; some locations were comprised of up to 3, usually smaller, ice-free sites. The Stuart (28 sites), Crooked (24), and Nechako (15) Rivers had the most ice-free sites, but only one site was used by swans on both the Stuart (#OW-13) and Nechako (#Irvine) Rivers. Swans were located at 26 open-water sites (Table 2) and were found predominantly on larger-sized sites (e.g., greater than 500 m in length and more than 5 m wide; Appendix B). Site #OW-13, a 30-km ice-free section of the Stuart River (between Kec Creek and Stuart Lake), had the most swans present – 426 birds (Appendix A).

Swans were mainly observed swimming and feeding in smaller groupings (<10 birds) within the open water areas, yet at the site with the most swans present (Site #OW-13, Stuart River), the majority of the birds were found in larger congregations (>50 birds) loafing along the edge of the ice. Swans observed along the Middle River appeared to be much more sensitive to the helicopter's disturbance than elsewhere, as many birds started to fly well before reaching them (e.g., >300 m). Some swans on the Nautley and Tachie Rivers were also found to be somewhat flighty. The few swans observed at the Tacheeda Lakes outlet were flushed when a snowmobile drove by on the adjacent logging road.

Other water-dependent wildlife observed using ice-free sites included 212 common goldeneyes, 121 mallards (*Anas platyrhynchos*), 104 common mergansers (*Mergus merganser*), 43 bald eagles (*Haliaeetus leucocephalus*), 34 American dippers (*Cinclus mexicanus*), and 3 Canada geese (*Branta canadensis*) (Table 2; Appendix A). Twenty-five (25) of the bald eagles were situated along the Stellako River, 14 were immature eagles. Eleven diving ducks, likely goldeneyes or mergansers, were also observed (Appendix A). These water-dependent wildlife used similar sites as swans, 29 of the 39 sites used by these species were also used by swans; for the 10 sites not jointly used with swans, all but one were used by bald eagles or American dippers. Pinchi Creek was the only watercourse that

had a significant stretch of open water (>5 km) and was not observed to be used by swans or other water-dependent wildlife species.

The 10 February aerial survey was conducted in 8.1 hrs, including ferry-time between the main survey areas. Weather conditions were relatively mild (-10°C, light northerly winds) with overcast skies (75-100% cover) and frequent light snow flurries. Early winter (November to January) temperatures for 2000/01 were slightly warmer than the 30-year normals (Table 1).

Conclusion

The February 2001 survey was the most extensive survey conducted in the Central Interior of BC and provided the highest winter trumpeter swan count for the area - 1,293 birds. With other swans potentially wintering in the Southern Interior (e.g., Kamloops and Lonesome Lakes), the over-wintering population of trumpeter swans in the Interior of BC for 2001 could be over 1,400 birds.

King (1981) suggested that the number of swans that remain in the Central Interior during winter is influenced greatly by the presence and duration of cold temperatures during early winter. If winter temperatures continue to remain warmer than past years (e.g., global warming), a greater number of swans may over-winter in the Central Interior of BC in the future.

Acknowledgements

I would like to thank Brad Arner (Ducks Unlimited, Prince George) and Pam Hengeveld (Boreas Consulting Services, Prince George) for volunteering their time to help conduct the survey and to Dave King who helped identify potential swan wintering areas outside of the Williston Reservoir watershed. Many thanks to Bert Irvine (local resident) and Don Olesiuk (BC Parks, Quesnel) for providing swan data from the upper Nechako River and Bowron Lake Park, respectively, and to Dave McAllister (MELP, Vanderhoof) and Crispin Guppy (MELP, Quesnel) for putting me in touch with Bert and Don. And, lastly, special thanks to Andre Breault (Canadian Wildlife Service, Surrey) and Chris Ritchie (MELP, Prince George) for their interest in the survey and for finding funds to conduct the survey.

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Appendix A: Trumpeter swan survey results, Central Interior (British Columbia), 10-14 February 2001.

Subsystem	Observer No	Observation Location Latitude Deg	Min	Longitude Deg	Min	TRUS Total	A	J	CAGO	MALL Total	M	F	Unid	COGO Total	M	F	Unid	COME Total	M	F	Unid	BAEA Total	Ad	Imm	AMDI	Unk Diver	Other	Comments
Nechako River	1	53	52 43	123	5 39	0				0				0				0				1	1					
Nechako River	2	53	54 69	123	13 66	0				0				0				0				1	1					on railway tracks at kill site
Nechako River	3	53	58 01	123	36 21	0				0				0				0				1	1					no open water kill site about 500m away
Nechako River	4	54	3 45	124	9 36	0				0				0				0				2	2					perched in tree 500m from river
Nechako River	5	54	3 90	124	17 51	0				0				0				0				0					1 elk	
Nechako River	6	54	6 60	124	21 19	0				0				0				0				0					1 wolf	coyote also spotted about 500m to E
Nechako River	7	54	6 57	124	29 09	0				0				0				0				0			2			
Nechako River	Irvine	53	41 00	124	51 00	130	116	14		40			40	0				0				0						1 swan with band on right leg
Subtotal - Nechako						130	116	14	0	40	0	0	40	0	0	0	0	0	0	0	0	5	5	0	2	0		
Nautley River	7B	54	4 85	124	37 40	66	61	5		30	5		25	7	4	3		0				2	2		1			about 12 flew during count
Subtotal - Nautley						66	61	5	0	30	5	0	25	7	4	3	0	0	0	0	0	2	2	0	1	0		
Stellako River	8	54	2 99	124	53 70	0				0				0				0				1	1					
Stellako River	8A	54	2 71	124	55 56	11	11			0				0				11	1	10		1	1		1			lower swan group, otter trails near falls/downriver
Stellako River	8B	54	0 88	124	58 98	32	32			11	8	3		38			8	30	15	3	12	23	9	14	11	2		swans from main bend to upper bridge
Subtotal - Stellako						43	43	0	0	11	8	3	0	38	0	8	30	26	4	22	0	25	11	14	12	2		
Francois Lake	10A	53	59 75	125	8 33	3	2	1		0				2			2	10	4	6		1	1			1		N side of lake
Francois Lake	10B	53	58 80	125	13 10	2	2			0				0				9	7	2		1	1					S side of lake (never islands)
Francois Lake	10C	53	56 78	125	12 00	6	5	1		0				0				7			7	1	1					S side of lake
Francois Lake	10D	53	58 54	125	7 10	1	1			0				0				2	1	1		0				1		S side of lake
Subtotal - Francois						12	10	2	0	0	0	0	0	2	0	0	2	28	12	9	7	3	3	0	0	2		
Stuart River	11A	54	0 51	123	33 97	0				0				0				0				1	1					
Stuart River	11B	54	6 04	123	33 21	0				0				0				0				0					1 otter	
Stuart River	12	54	12 38	123	54 79	0				0				0				0				1	1					swan tracks
Stuart River	13A	54	15 58	124	6 20	1	1			0				1			1	0				0						
Stuart River	13B	54	16 38	124	8 45	5	4	1		0				0				3	2	1		0						
Stuart River	13C	54	16 43	124	9 76	9	9			0				0				0				0						
Stuart River	13D	54	16 53	124	9 09	8	6	2		0				2	2			0				0						
Stuart River	13E	54	17 03	124	9 58	56	33	23		0				0				0				0						most birds loafing
Stuart River	13F	54	17 72	124	11 09	12	7	5		0				0				0				0						
Stuart River	13G	54	18 38	124	12 32	21	13	8		0				0				0				0						
Stuart River	13H	54	18 68	124	12 62	12	10	2		0				0				0				1	1					
Stuart River	13I	54	19 26	124	13 20	12	12			0				0				0				0						
Stuart River	13J	54	19 59	124	13 48	129	125	4		0				0				0				1	1			1		almost all birds loafing on ice
Stuart River	13K	54	20 50	124	14 71	151	120	31		0				6	3	3		5			5	0						almost all birds loafing on ice
Stuart River	13L	54	21 96	124	13 88	2	2			0				80	1		79	22			22	0						
Stuart River	13M	54	25 48	124	16 15	4	2	2		0				0				0				2	2			3		
Stuart River	13N	54	26 15	124	16 01	4	2	2		0				0				0				0						Stuart Lake mouth
Subtotal - Stuart						426	345	80	0	0	0	0	0	89	6	4	79	30	2	1	27	6	6	0	0	4		
Tachie River	14	54	39 59	124	46 12	0				0				0				0				1	1					
Tachie River	15	54	40 99	124	47 48	3	2	1		0				0				0				0						200m u/s of railway bridge
Tachie River	16A	54	46 42	124	52 95	2	2			0				0				0				0			1	2		
Tachie River	16B	54	46 77	124	53 21	2	2			0				0				0				0			1			
Tachie River	16C	54	47 25	124	52 80	10	8	2		0				5			5	6	6			0			1			
Tachie River	16D	54	47 84	124	53 56	20	18	2		0				0				0				0			1			
Tachie River	17	54	48 53	124	54 50	104	84	20		0				0				0				0						
Subtotal - Tachie						141	116	25	0	0	0	0	0	5	0	5	0	6	6	0	0	1	1	0	4	2		
Middle River	18	54	56 17	125	16 47	82	67	15		0				12			12	0				0						
Middle River	19	54	56 96	125	17 25	78	53	25		0				13			13	0				0						swans flighty
Middle River	20	54	59 40	125	22 85	29	21	8		0				0				0				0				1		
Middle River	21	55	0 55	125	23 98	19	14	5		0				0				0				0						
Middle River	22	55	2 11	125	27 13	137	120	17		13	2	3	8	15	1	6	8	0				1	1					u/s & d/s of bridge
Subtotal - Middle						345	275	70	0	13	2	3	8	40	1	6	33	0	0	0	0	1	1	0	0	1		

continued

Appendix A: continued.

System	Obs'n No	Observation Location: Latitude Deg	Latitude Min	Longitude Deg	Longitude Min	TRUS Total	TRUS A	TRUS J	CAGO	MALL Total	MALL M	MALL F	MALL Uncl	CGGO Total	CGGO M	CGGO F	CGGO Uncl	COME Total	COME M	COME F	COME Uncl	BAEA Total	BAEA Ad	BAEA Imm	AMDI	Unk Diver	Other	Comments
Nation Lakes/River	23	55	11.90	124	45.36	6	6			0				14	2	12		4	2	2		0			2			
Nation Lakes/River	24	55	11.49	124	18.50	10	8	2		0				12			12	1		1		0			1			
Subtotal - Nation						16	14	2	0	0	0	0	0	26	2	12	12	5	2	3	0	0	0	0	3	0		
McLeod River	25	54	48.71	125	19.53	4	4			9	4	5		0				0				0			2			near Carp Lake outlet
Subtotal - McLeod						4	4	0	0	9	4	5	0	0	0	0	0	0	0	0	0	0	0	0	2	0		
Tacheeda Lakes	27	54	43.75	122	30.08	4	3	1		0				0				0				0			1			flew when snowmobile went by, old site #76
Subtotal - Tacheeda						4	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0		
Crooked River	26	54	43.05	122	47.30	0				0				2			2	0				0						Kerry Lk bridge, old site #24ix
Crooked River	28	54	50.01	122	43.78	4	2	2		0				0				0				0						old site #17
Crooked River	29	54	29.64	122	43.51	56	36	20		12	7	5		1		1		9	9			0			4			old site #16
Crooked River	30	54	23.77	122	38.22	7	7			0				0				0				0						narrow site along trees, old site #10
Crooked River	31	54	23.38	122	38.09	27	23	4	3	6	4	2		2		2		0				0			2			old sites #6 to 9
Subtotal - Crooked						94	68	26	3	18	11	7	0	5	0	3	2	9	9	0	0	0	0	0	6	0		
Arctic Lake	32	54	28.45	121	44.59	0				0				0				0				0			3			old site #82
Subtotal - Arctic						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0		
Bowron River	B1	53	15.50	121	24.50	3	3			0				0				0				0						on river near bridge at N end of Bowron Lk
Swan Lake	B2	53	11.60	121	18.20	3	3			0				0				0				0						E end of Swan Lk near Bowron R cabin
Babcock Creek	B3	53	4.30	121	10.20	4	4			0				0				0				0						Babcock Ck at S end of Babcock Lk
Antler Creek	B4	53	15.40	121	24.70	2	2			0				0				0				0						on Antler Ck
Subtotal - Bowron						12	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		

Watershed	TRUS Total	TRUS A	TRUS J	CAGO	MALL Total	MALL M	MALL F	MALL Uncl	CGGO Total	CGGO M	CGGO F	CGGO Uncl	COME Total	COME M	COME F	COME Uncl	BAEA Total	BAEA Ad	BAEA Imm	AMDI	Unk Diver	Other
Subtotal - Nechako	130	116	14	0	40	0	0	40	0	0	0	0	0	0	0	0	5	5	0	2	0	
Subtotal - Nautley	66	61	5	0	30	5	0	25	7	4	3	0	0	0	0	0	2	2	0	1	0	
Subtotal - Stellako	43	43	0	0	11	8	3	0	38	0	8	30	26	4	22	0	25	11	14	12	2	
Subtotal - Francois	12	10	2	0	0	0	0	0	2	0	0	2	28	12	9	7	3	3	0	0	2	
Subtotal - Stuart	426	346	80	0	0	0	0	0	89	6	4	79	30	3	1	27	6	6	0	0	4	
Subtotal - Tache	141	116	25	0	0	0	0	0	5	0	5	0	6	6	0	0	1	1	0	4	2	
Subtotal - Middle	348	275	70	0	13	2	3	8	40	1	6	33	0	0	0	0	1	1	0	0	1	
Subtotal - Nation	16	14	2	0	0	0	0	0	26	2	12	12	5	2	3	0	0	0	0	3	0	
Subtotal - McLeod	4	4	0	0	9	4	5	0	0	0	0	0	0	0	0	0	0	0	0	2	0	
Subtotal - Tacheeda	4	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	
Subtotal - Crooked	94	68	26	3	18	11	7	0	5	0	3	2	9	9	0	0	0	0	0	6	0	
Subtotal - Arctic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	
Subtotal - Bowron	12	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	1293	1069	225	3	121	30	18	73	212	15	41	156	104	35	35	34	43	29	14	34	11	
		17.4%																				

All sites surveyed on February 10, 2001, except Observation #Imm (February 11, 2001) and Observation #B1 to B4 (February 14, 2001)

Appendix B: Characteristics of ice-free sites surveyed within the Central Interior, British Columbia, 10 February, 2001.

System	Obs'n No	Loc'n No	General Location	Location Start Latitude Deg	Latitude Min	Longitude Deg	Longitude Min	Location End Latitude Deg	Latitude Min	Longitude Deg	Longitude Min	Site Characteristics Length	Width	Comments	Photographs No	Photographs Comments
Nechako River	1&2	OW-1	1	53	58 79	122	49 02	53	59 14	123	15 91	5	5	faster water		
Nechako River		OW-2	Hutchison E	53	58 52	123	20 19					1	1	2 smaller sites ~400m to S of coordinates		
Nechako River		OW-3	Hulatt Rd area	53	58 16	123	43 16					1	2	3 smaller sites		
Nechako River		OW-4	McCall to Braeside	54	3 99	124	10 48					2	3	small site ~200m to S		
Nechako River		OW-5	McCall to Braeside	54	4 26	124	14 53					3	1	moderate narrower site		
Nechako River	5	OW-6	McCall to Braeside	54	3 90	124	17 51					1	2	elk on road on N side		
Nechako River		OW-7	McCall to Braeside	54	4 30	124	18 20					1	3			
Nechako River	6	OW-8	Braeside area to Kluk Ck	54	5 87	124	20 10	54	6 60	123	21 10	4	3	wolf at u/s end		
Nechako River		OW-9	Braeside area to Kluk Ck	54	7 45	124	21 30					3	2	moderate narrower site		
Nechako River		OW-10	Kluk Ck to E of Tatsutnai Ck	54	7 08	124	25 21					1	1	small site		
Nechako River		OW-11	Kluk Ck to E of Tatsutnai Ck	54	6 49	124	28 23					1	1	small site		
Nechako/Nautley	7&7B	OW-12	Tatsutnai E (Nechako) to Fraser Lk	54	6 57	124	29 09	54	4 85	124	37 40	5	5		1-24to13 6-25to23	Nautley bridge area swans & Nautley confluence
Stellako River	8	OW-13	Stellako R (d/s of Hwy 16)	54	2 89	124	53 77					3	3	2 med d/s of bridge x'ing	1-12	site
Stellako River	9	OW-14	Stellako R (u/s of Hwy to Francois Lk)	54	2 90	124	54 73	54	0 58	125	0 51	5	5		1-11to5 2- 24to17 6- 22to19	group 9A&B from 54 2 73/124 55 36 & 54 1 73/124 58 12
Francois Lake	10	OW-15	west of Glenannan	53	59 58	125	2 82	53	59 50	125	13 00	5	5	lake still ice free to W but did not survey	1-4to1 6-18	Francois Lake swans & W of survey area
Stuart River	11A	OW-16	near confluence to S of Burnstead Ck	54	0 51	123	33 97	54	5 90	123	32 40	5	5	faster water	2-16to13	#13 @ 54 5 57/123 30 49
Stuart River	11B	OW-17	Burnstead Ck to Manalay Ck	54	6 04	123	33 21	54	7 14	123	33 45	4	5		2-12	site
Stuart River		OW-18	Burnstead Ck to Manalay Ck	54	7 35	123	32 88					2	3			
Stuart River		OW-19	Burnstead Ck to Manalay Ck	54	7 80	123	32 02	54	8 39	123	32 03					
Stuart River		OW-20	Burnstead Ck to Manalay Ck	54	8 61	123	31 98	54	8 91	123	31 92	3	2			
Stuart River		OW-21	Mandalay Ck area	54	9 29	123	31 41	54	9 38	123	32 45	4	5	Mandalay Ranch area	2-11	start of area
Stuart River		OW-22	bridge to Breadalbane Ck	54	9 95	123	38 59					2	3	1 small		
Stuart River		OW-23	bridge to Breadalbane Ck	54	10 48	123	40 80					2	3			
Stuart River		OW-24	bridge to Breadalbane Ck	54	10 85	123	43 76					1	1			
Stuart River		OW-25	bridge to Breadalbane Ck	54	10 97	123	45 03							1 small		
Stuart River		OW-26	bridge to Breadalbane Ck	54	11 11	123	45 84	54	11 39	123	48 60	2	4	3 medium sites		
Stuart River		OW-27	bridge to Breadalbane Ck	54	11 58	123	47 37					2	4	1 medium site		
Stuart River		OW-28	bridge to Breadalbane Ck	54	12 12	123	49 84					1	2	1 small		
Stuart River		OW-29	bridge to Breadalbane Ck	54	11 94	123	50 46					1	1	3 small		
Stuart River		OW-30	Breadalbane Ck to Kec Ck	54	12 20	123	52 07					1	2	3 smaller sites within 400m		
Stuart River		OW-31	Breadalbane Ck to Kec Ck	54	12 16	123	53 74					2	4	1 medium site		
Stuart River	12	OW-32	Breadalbane Ck to Kec Ck	54	12 38	123	54 79					3	5	1 medium site		
Stuart River		OW-33	Breadalbane Ck to Kec Ck	54	12 69	123	55 57	54	12 48	123	58 40	3	4	1 lgr med		
Stuart River		OW-34	Breadalbane Ck to Kec Ck	54	12 73	123	56 15					3	3	3 medium sites within ~500m		
Stuart River		OW-35	Breadalbane Ck to Kec Ck	54	14 39	124	2 11					1	1	1 small		
Stuart River	13A-N	OW-36	Kec Ck to Stuart Lk	54	14 78	124	3 84	54	20 15	124	16 01	5	5		2-10to1 3-24to17 6-17	just d/s of swans A to I J to L & J swan photo
Pinchie Creek		OW-37	Stuart Lk to Pinchie Lk	54	33 83	124	29 50	54	36 93	124	29 76	5	3	entire creek ice free		
Tachie River	14	OW-38	Tachie R mouth to Kuzkwa R	54	39 59	124	46 12					2	3	small site at mouth (N of island)		
Tachie River		OW-39	Tachie R mouth to Kuzkwa R	54	40 65	124	47 98					1	2			
Tachie River	15	OW-40	Tachie R mouth to Kuzkwa R	54	40 99	124	47 48	54	42 30	124	47 88	5	5	lends near bridge	3-16 6-16to15	lower Tachie site (to S) & swans
Tachie River		OW-41	Tachie R mouth to Kuzkwa R	54	42 54	124	47 83	54	42 95	124	48 12	3	4	3 moderate sites		
Tachie River		OW-42	Tachie R mouth to Kuzkwa R	54	44 10	124	50 06					2	3	2 sm-md sites		
Tachie River	16A-D	OW-43	Tachie R mouth to Kuzkwa R	54	45 00	124	51 14	54	47 84	124	53 56	5	5		3-15to9	site and swans
Tachie River		OW-44	Kuzkwa R to Trembleur Lk	54	48 08	124	53 71					2	4		3-8to5	site and swans
Tachie River	17	OW-45	Kuzkwa R to Trembleur Lk	54	48 53	124	54 50	54	48 62	124	55 42	4	5		6-14	swans
Tachie River		OW-46	Kuzkwa R to Trembleur Lk	54	48 64	124	56 51	54	49 22	124	57 82	4	5	lends at Trembleur Lake		

continued

Appendix B: continued.

System	Obs'n No	Locn No	General Location	Location Start Latitude Deg	Latitude Min	Longitude Deg	Longitude Min	Location End Latitude Deg	Latitude Min	Longitude Deg	Longitude Min	Site Characteristics Length	Width	Comments	Photographs No	Photographs Comments
Middle River		OW-47	Kazchek Ck to Van Decar Ck	54	52.97	125	9.90	54	53.47	125	10.79	4	5	2 swimmer sites at S end		
Middle River		OW-48	Kazchek Ck to Van Decar Ck	54	53.71	125	10.89					3	4			
Middle River		OW-49	Kazchek Ck to Van Decar Ck	54	53.96	125	11.38					2	4			
Middle River		OW-50	Kazchek Ck to Van Decar Ck	54	54.78	125	13.75					1	4			
Middle River	18	OW-51	Kazchek Ck to Van Decar Ck	54	56.17	125	16.47					4	5	2 sites	3-4to1 13to8	6- site (to N) and swans flying
Middle River	19	OW-52	Kazchek Ck to Van Decar Ck	54	56.96	125	17.25	54	56.20	125	20.96	5	5			
Middle River	20	OW-53	Van Decar Ck to Natazutlo Ck	54	59.40	125	22.65	55	0.35	125	23.09	5	5	N of Van Decar Ck	6-7	N end of site (to S)
Middle River	21	OW-54	Natazutlo Ck to Takla Lake	55	0.55	125	23.98	55	0.76	125	24.47	3	5	ends near Natazutlo Ck	4-24to23 6-6	swan and site to S
Middle River	22	OW-55	Natazutlo Ck to Takla Lake	55	2.11	125	27.13	55	3.68	125	30.53	5	5	u/s & d/s of bridge, ends at Takla Lake	4-22to17	swans
Nation Lakes	23	OW-56	betw Tchentlo & Chuchi	55	11.69	124	47.30	55	11.58	124	44.09	5	5		6-5to4	E end of Tchentlo (to E) & W end of Chuchi (to W)
Nation Lakes	24	OW-57	Chuchi outlet to u/s of bridge	55	11.29	124	23.97	55	11.76	124	16.32	5	5		4-16to15 6-3	swan lock on Nation River, Chuchi outlet
Nation Lakes		OW-58	u/s to d/s of bridge	55	11.86	124	16.07	55	12.20	124	12.83	5	4	couple of spots (~25m) frozen in u/s of bridge		
McLeod River	25	OW-59	Carp Lk to War Lk	54	48.71	123	19.53	54	49.86	123	19.95	5	2		4-14to13	Carp Lk outlet
McLeod River		OW-60	Carp Lk to War Lk	54	50.16	123	19.94					1	1	med & narrow		
McLeod River		OW-61	d/s of War Lk	54	51.58	123	18.11	54	52.46	123	15.28	4	3		4-12	McLeod R u/s & d/s of bridge
McLeod River		OW-62	d/s of War Lk	54	52.46	123	15.28	54	54.02	123	13.28	4	1	narrow and patchy so stopped surveying		
Crooked River		OW-63	near Weedon Ck confluence	54	47.06	122	49.67					3	2	old site #26		
Crooked River		OW-64	near Altezega Ck	54	44.98	122	46.11					1	1	2 smaller sites		
Crooked River	26	OW-65	Kerry Lake FSR bridge	54	43.05	122	47.30	54	42.80	122	47.45	3	4	2 sites (x & w joined), old #24-w	4-11	site
Crooked River		OW-66	Kerry Lk to Redrocky Lk	54	39.24	122	45.61							amoeba-like		
Crooked River		OW-67	Kerry Lk to Redrocky Lk	54	38.87	122	44.90	54	38.39	122	44.52	3	4	2 sites, near nestbox N of Red Rocky, old #25	6-2	site (to N)
Tacheeda Lakes		OW-68	Tacheeda - W end of west lake	54	40.08	122	35.24					1	2			
Tacheeda Lakes		OW-69	Tacheeda - betw lakes	54	42.48	122	31.75					3	2		4-10	betw lakes
Tacheeda Lakes	27	OW-70	Tacheeda - outlet	54	43.75	122	30.06	54	43.97	122	30.04	3	3	lots of snowmobile tracks, old site #76	4-9to7	outlet
Crooked River		OW-71	Redrocky Lk to Davie Lk	54	35.83	122	43.93	54	34.44	122	44.45	4	3	Angusmac Ck area, old #20 & 21	4-6to4	site
Crooked River		OW-72	Redrocky Lk to Davie Lk	54	34.17	122	44.79					1	2	Davie Lk outlet, old site #19		
Crooked River	28	OW-73	Crooked R Provl Park area	54	30.43	122	42.49	54	29.71	122	43.56	4	3	old site #17	4-3to2	site
Crooked River	29	OW-74	Crooked R Provl Park area	54	29.64	122	43.51	54	28.62	122	43.12	5	5	old site #16	4-1 & 24to20	5- site and swans
Crooked River		OW-75	Crooked R Provl Park area	54	28.47	122	43.[illegible]					2	1	small & narrow		
Crooked River		OW-76	Crooked R Provl Park area	54	28.47	122	4[illegible].30					1	2	small & wider		
Crooked River		OW-77	100 FSR bridge to Summit Lk	54	24.94	122	38.64					3	3	site in forested area, old #12	4-16to15	site
Crooked River		OW-78	100 FSR bridge to Summit Lk	54	27.57	122	42.19					3	1	old #14		
Crooked River		OW-79	100 FSR bridge to Summit Lk	54	26.89	122	39.15	54	26.69	122	39.32	3	4	old #13	4-17	site
Crooked River		OW-80	100 FSR bridge to Summit Lk	54	25.20	122	39.03	54	24.76	122	38.74	4	4	old #11	4-16to15	site
Crooked River	30	OW-81	100 FSR bridge to Summit Lk	54	23.77	122	38.22					2	2	narrow site along trees, old #10	4-14to13	site
Crooked River	31	OW-82	100 FSR bridge to Summit Lk	54	23.38	122	38.09	54	22.17	122	38.98	4	4	old #9, 8, 7 & 6	4-12to8	site
Crooked River		OW-83	100 FSR bridge to Summit Lk	54	21.65	122	39.40	54	21.38	122	39.66			old #4		
Crooked River		OW-84	100 FSR bridge to Summit Lk	54	21.00	122	39.95	54	20.46	122	40.24	3	4	old #2 & 3	4-7	site
Crooked River		OW-85	100 FSR bridge to Summit Lk	54	19.61	122	40.13					2	4	Summit Lk outlet, old #1	4-6	site
Arctic Lake	32	OW-86	Arctic Lk outlet	54	26.45	121	44.59	54	25.90	121	42.58	4	2	patchy, old site #82	4-5to4	site

Where

Length	Width
1 = <20 m	1 = 2.5 m
2 = 20 to 99 m	2 = 2.5 to 4.9 m
3 = 100 to 499 m	3 = 5.0 to 7.4 m
4 = 500 to 999 m	4 = 7.5 to 9.9 m
5 = >1,000 m	5 = >10.0 m